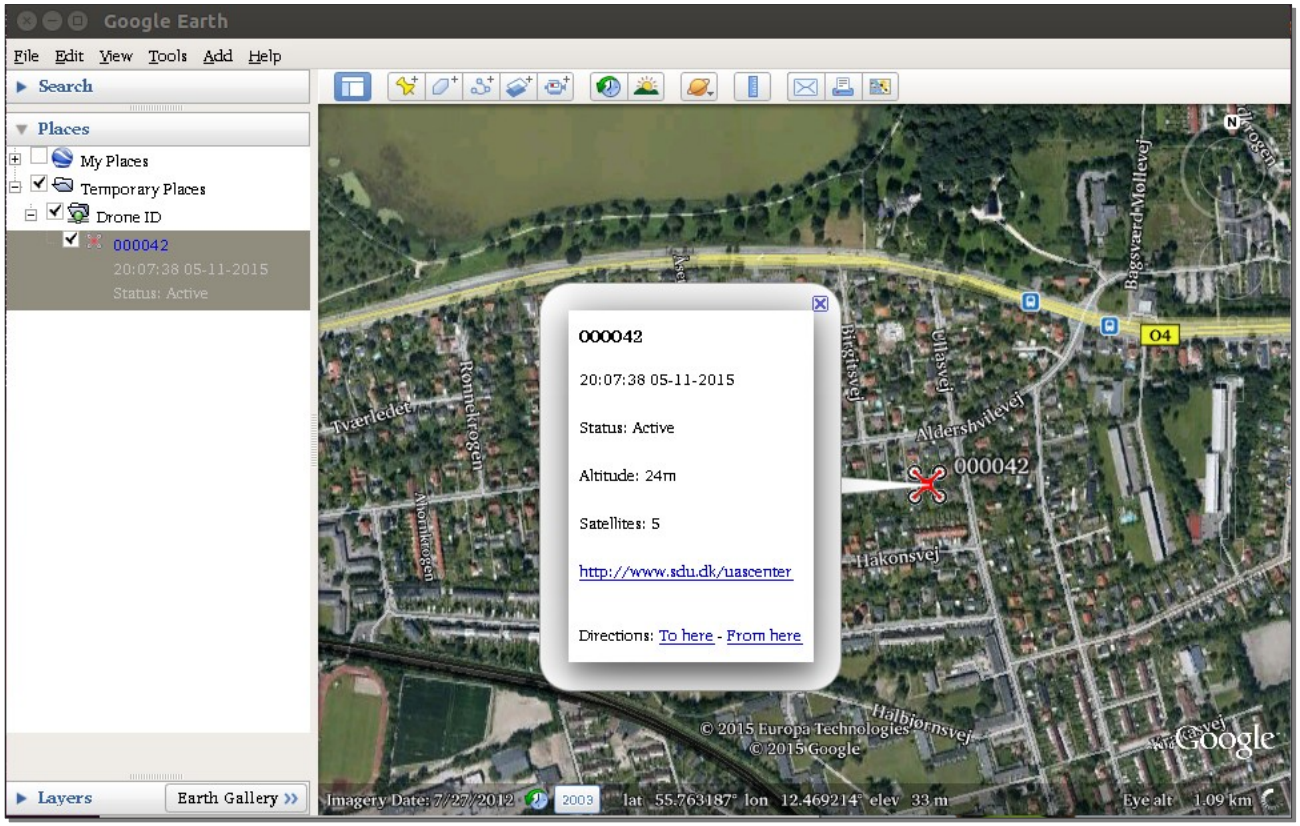
Drone ID

Drone identification and activity monitoring.



Workshop, Danish Transport and Construction Agency

November 30th, 2015

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Cand.Scient. PhD
SDU UAS Center

Agenda

1. Welcome
2. Presentation of the project and tentative results.
3. Presentation of Apps for drone flight registration.
4. Presentation af a DroneID prototype based on on-site monitoring.
5. Feedback on the presentations.
6. Transport to the model airfield Celinevej, Amager.
7. Live demonstration of DroneID prototypes and access to drone flight information for authorities.
8. Feedback on demonstrations and conclusion at the model airfield.

Drone ID architecture

On-site monitoring

Beacon

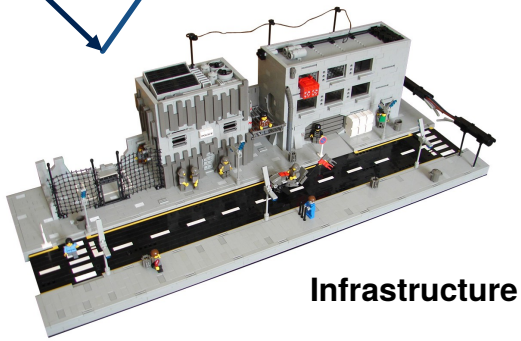
UAS Traffic Management (UTM)

Access

Drone flight pre-registration

Handheld

Vehicle



Infrastructure

Drone ID architecture

Network

GPRS modem

Access

UAS Traffic Management (UTM)

Cell tower

Drone flight pre-registration

Drone ID record

Flight

- Activity ID — unique
- Status — planned/ongoing/completed/cancelled
- Start — date and time
- End — date and time
- Geofence — polygon describing boundary of operation
- Type — commercial/recreational
- Purpose — specified e.g. training/inspection/transport etc.

Drone

- Drone ID — issued by authority
- Type — autofill if ID is available
- Payload — e.g. camera/sensor

Pilot

- Name
- Address
- Phone
- Email
- Company

Authorization

- Status — not required/pending/approved/denied
- Authorities — autofill based on location and drone ID

UAS Traffic Management (UTM)

Activity records will automatically be validated (based on drone ID and geofencing) against static and dynamic restricted zones and submitted for approval by relevant authority.

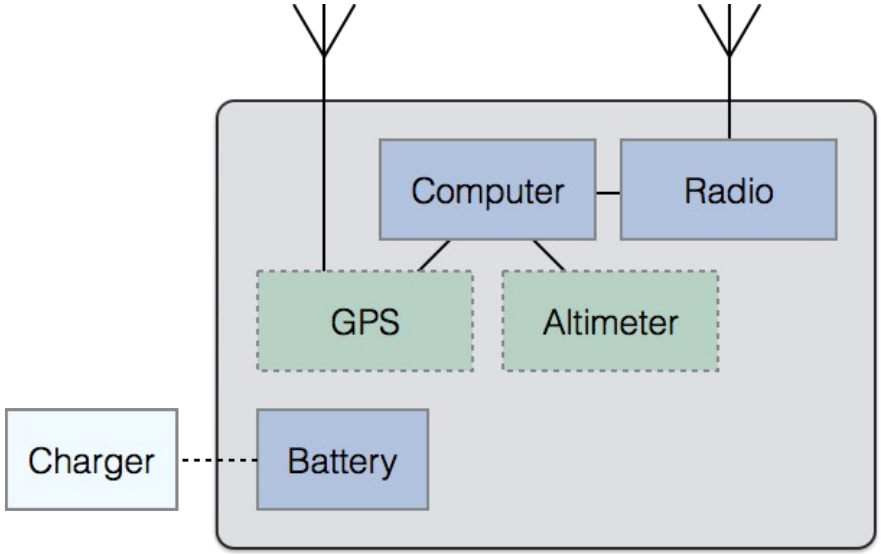
Drone ID prototype

Beacon data

- Unique ID issued by authority
- Optional data (based on sensors):
  - Position, elevation
  - Velocity, heading
  - Flight time
- Rolling key encryption to prevent unauthorized access and spoofing

Hardware

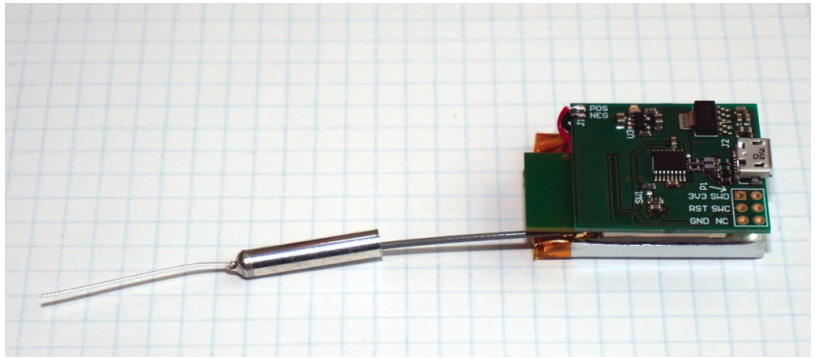
- Self contained, no interface to drone
- Very small form factor
- Light weight
- Low power operation
- Beacon interval 1 second
- Optional GPS and altimeter



Hardware modules

Drone ID beacon

On site monitoring

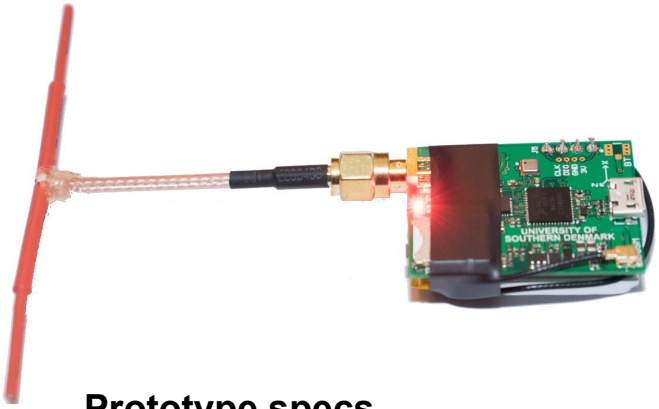


Prototype specs.

- Wifi radio
- External 2.4 GHz antenna
- Weight approx. 10 g
- No connections to the drone
- Micro USB charging

- Expected working range 500 - 1000m
- May require receiver hardware, antenna etc.
- No ground based infrastructure.
+ Lower size, weight, power.
+ Lower price

Network



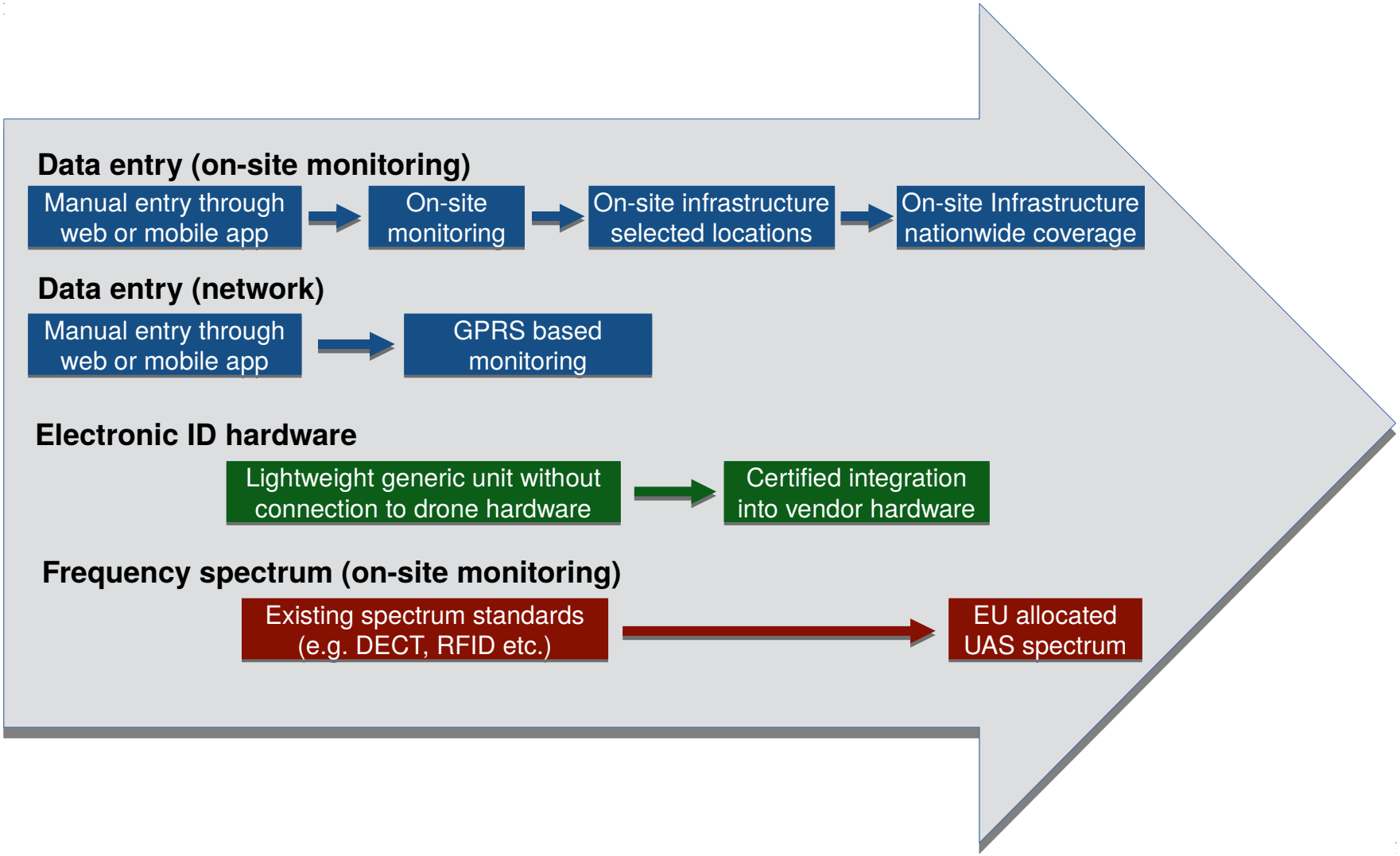
Prototype specs.

- GPRS modem
- GPS with external dipole antenna*
- Weight approx. 20 g
- No connections to the drone
- Micro USB charging
- Battery lasts approx. 3 hours of flight time.

- Coverage limited by network (potential MVNO roaming).
+ No receiver hardware needed.
+ Infrastructure already established
- Higher size, weight, power.
- Higher price.
- Requires SIM card and subscription.

**The external dipole antenna allows installation of the DroneID on the side or beneath the drone body.*

Implementation road map



Current experiment

- 10 drone operators use a GPRS/GPS based DroneID prototype for one month starting mid November 2015.
- Workshops with drone operators, industrial partners, the police and other stakeholders focusing on user experience and feedback, on-site monitoring demonstrations, etc.
- Documentation completed ultimo 2015.
- Hardware and software developed by SDU within the project released as open source.

Partners

- Danish Transport and Construction Agency
- University of Southern Denmark
- *UAS Denmark*

Companies contributing to the project

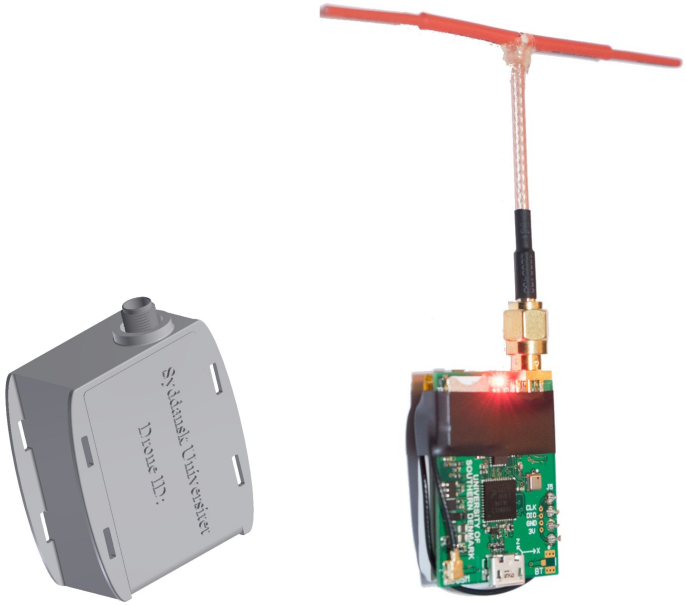
- DroneSoft ApS (mobile App showcase)
- Resiewe A/S (on-site DroneID prototype showcase)
- Scandinavian Avionics A/S (on-site DroneID prototype showcase)

Startup workshops

- November 17th and 18th 2015.
- Information to the operators about the project and experiment.
- Installation and test of GSM based DroneID prototypes and web access to flight data.
- Installation and test of the DroneSoft App

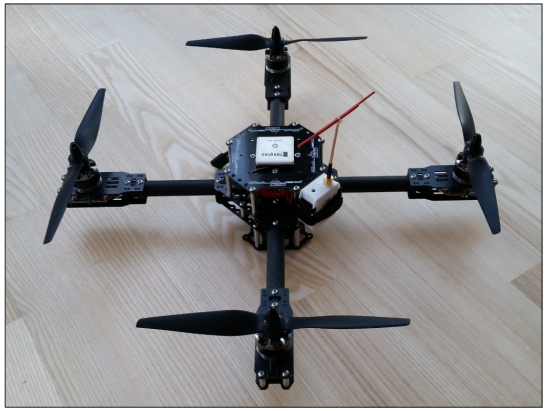
Installation guidelines

- DroneID must be installed on the side or beneath the drone body unless it can be ensured that the drone GPS antenna is not obstructed.
- DroneID must be installed as far away from other antennas with the DroneID logo (and hence GSM antenna) facing away from the drone body.
- DroneID GPS dipole antenna must have a clear view of the sky without obstructing the drone GPS antenna or touching the propellers. Antenna and cable should not be directly parallel to or near other antennas.
- Mount using electrical tape, velcro, cable binders etc.



Installation examples

MikroKopter



Viacopter EduQuad

senseFly eBee

DJI Inspire 1

DJI Phantom 2

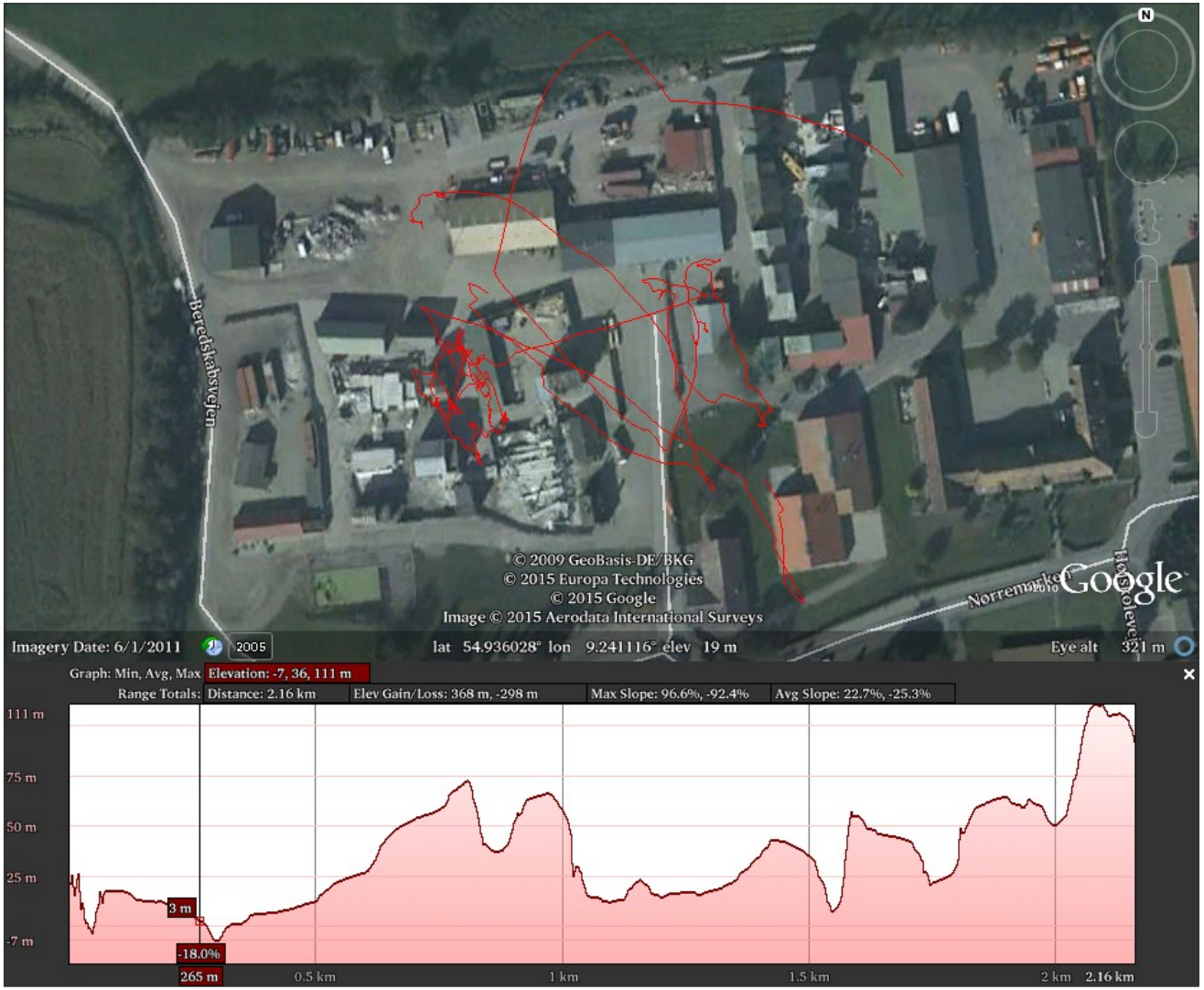
DJI S900

Crop surveying example

Aarhus University, ebee drone, windy conditions.

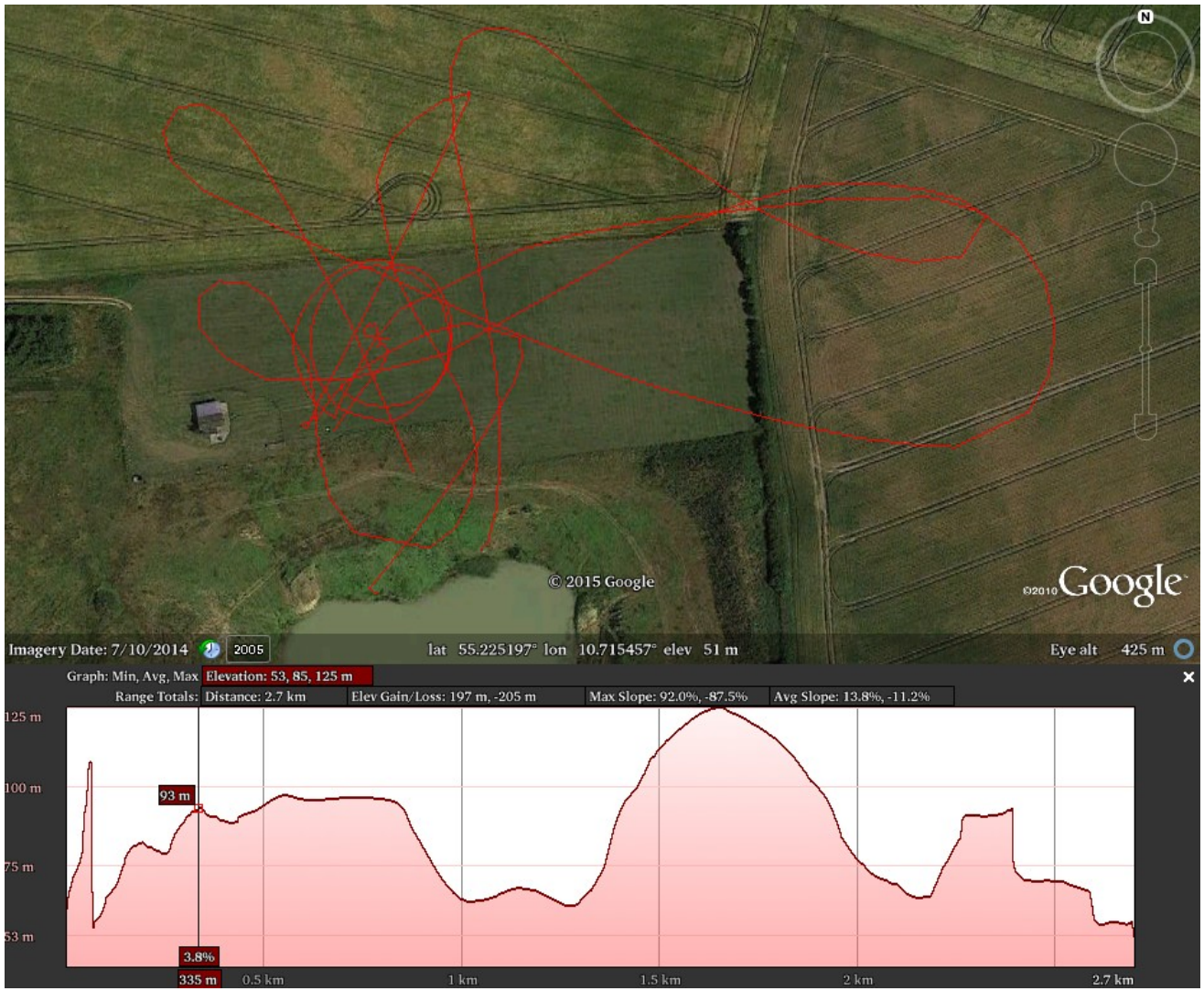
Manual inspection example

Danish Emergency Managment Agency, DJI Phantom 2



Test flight example

Odense Municipality, DJI Inspire 1



GPS track comparison

DroneID prototype vs. AutoQuad flight controller.

Some tentative conclusions

- The DroneID prototype seems to work to the extent tested. Errors and deficiencies discovered so far can be fixed in software or hardware.
- Data from the DroneID barometer and IMU will add valuable information when analyzing the drone state etc.
- User interface is too complicated. The operator already has many things on his mind while planning and performing flights. A simpler user interface will be tested on select operators for the rest of the experiment period.
- Despite a fairly high battery capacity the use pattern sometimes causes the battery to run flat. This may be solved in software. Remaining battery time must be clearly indicated, ideally through the app.

Thank you for listening!

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